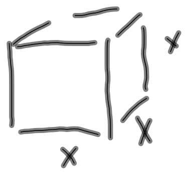
31. side inc at $.2 \frac{cm}{sec} = \frac{dx}{dt}$

in terms of surface area (s) what is rate of volume $\frac{dv}{dt}$



x = side length

v = volume

$$V = (x)^3$$

$$\frac{dv}{dt} = 3x^2 \cdot \frac{dx}{dt}$$

$$= 3x^2 (.2)$$

$$s = 6x^2$$

$$x^2 = \frac{s}{6}$$

$$\frac{dv}{dt} = 3 \cdot \frac{s}{6} \cdot .2$$

$$= .1 s$$

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$$\int_{-1}^{2} f(3x)\, dx \qquad F'(x) = f(x)$$

$$\frac{1}{3} F(3x) \Big|_{-1}^{2} = \frac{1}{3}\left(F(6) - F(-3)\right)$$

$$\frac{d}{dx} F(3x) = 3 f(3x)$$

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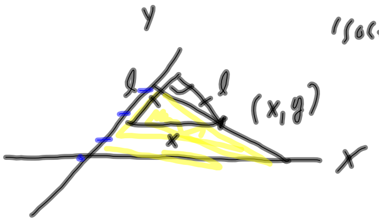
39. $x + 3y = 9$ ~~⊥ y axis~~

isosceles Rt



$$\int_0^3 \frac{1}{2} l^2 \, dy$$

$$l^2 + l^2 = x^2$$

$$2l^2 = x^2$$

$$l^2 = \frac{x^2}{2}$$

$$\int_0^3 \frac{1}{2} \frac{x^2}{2} \, dy$$

$$x = 9 - 3y$$

$$\frac{1}{4} \int_0^3 (9-3y)^2 \, dy$$

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40. $f(x) = x^6 - x^4$ $f'(x) = -1$

$$f'(x) = 6x^5 - 4x^3 = -1$$

$$x = -.934$$

$$y =$$

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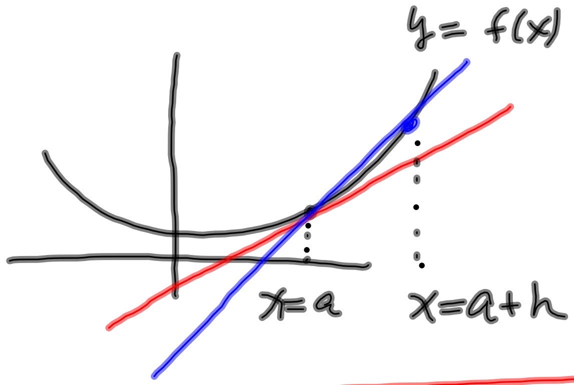
review 6 derivative at a point



$$\boxed{f'(a) = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h}}$$

formal definition of the derivative

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$$\lim_{h\to 0} \frac{(2+h)^7 - 2^7}{h} = 7\cdot 2^6$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} = f'(2)$$

$a = 2$

$f(x) = x^7$

$$f'(2) = f'(x) = 7x^6 \Big|_{x=2} = 7\cdot 2^6$$

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$$\lim_{h \to 0} \frac{\ln(2+h) - \ln 2}{h}$$

$$f(x) = \ln x$$

$$f'(x) = \frac{1}{x}\Big|_{x=2} = \frac{1}{2}$$

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let $f(x) = \begin{cases} x^2 \sin\frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$

a) find $f'(0)$ using the formal def of der.

$$f'(0) = \lim_{h \to 0} \frac{f(0+h) - f(0)}{h}$$

$$\lim_{h \to 0} \frac{\cancel{f(h)}}{h}$$

$-1 \leq 0 \cdot \leq 1$

$$\lim_{h \to 0} \frac{\cancel{h^2 \sin\frac{1}{h}}}{h} = \lim_{h \to 0} h \sin\frac{1}{h}$$

b) $f'(x)$ if $x \neq 0$ $\qquad f'(0) = 0$

$f(x) = x^2 \cdot \sin(\frac{1}{x})$

$f'(x) = 2x \sin\frac{1}{x} + x^2 \cdot \cos\frac{1}{x} \cdot \left(\frac{-1}{x^2}\right)$

$= 2x \sin\frac{1}{x} - \cos\frac{1}{x}$

c) $f'(x) = \begin{cases} 2x \sin\frac{1}{x} - \cos\frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$

show $f'(x)$ is <u>not</u> continuous at $x=0$

$$\lim_{x \to 0} 2x \sin\frac{1}{x} - \cos\frac{1}{x} = \text{dne}$$

by oscillation

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